

## REMARKS

Applicants wish to thank the Examiner, Fernando L. Toledo, for the telephone interview with Applicants' Attorney, David T. Millers, on January 24, 2006. During the interview, the relevance of Sankar Das Sarma, "Spintronics," American Scientist Vol. 89, pp 516-523 (2001), hereinafter Sarma, to Applicants' claims was discussed. No agreement as to the patentability of the claims was reached.

Claims 1-21 were pending in the above-identified application when last examined and stand rejected. The Office Action dated December 29, 2005 made the rejection final. Pursuant to 37 C.F.R. § 1.114, Applicants request continued examination of the above-identified patent application and entry of the above-amendment of the claims. Applicants also request consideration of the attached declaration of the inventor, which identifies an apparent error in Sarma.

Claims 1-21 were rejected under 35 U.S.C. § 102(b) as anticipated by Sankar Das Sarma, "Spintronics," American Scientist Vol. 89, pp 516-523 (2001), hereinafter Sarma. Applicants respectfully traverse the rejection.

Independent claim 1 distinguishes over Sarma at least by reciting, "a wire positioned relative to the control region so that a current through the wire creates in the control region a magnetic field that rotates spins of the electrons traversing the control region." Sarma fails to suggest electron spins interacting with a magnetic field produced by a current through a wire. As noted in Applicants prior response, Sarma describes the Datta-Das spin transistor which uses a charge or a voltage on a gate and the Rashba interaction to rotate the spins of electrons passing between magnetic regions. Sarma does not suggest a current through a wire creating a magnetic field that rotates spins.

As mentioned by Applicants' attorney during the January 24, 2006 telephone interview with the Examiner, Sarma contains an apparent error on page 518 in referring to a "gate current" when a gate voltage or gate field was intended. The idea that gate field, not gate current, is used in Das-Datta spin field-effect transistor is clear from a more recent review paper co-authored by the same author Das Sarma. See Zutic et al., "Spintronics: Fundamentals and Applications," Rev. Mod. Phys. Vol. 76, p 323 (2004), copies of pages 323 and 324 attached. Fig. 1 on page 324 shows the Datta-Das field-effect spin transistor, and the caption of Fig. 1 explains "Electron spins precess about the precession vector  $\Omega$ , which arises from spin-orbit coupling... The magnitude of  $\Omega$  is tunable by the gate voltage  $V_G$  at the top of the channel." The term a field-effect is used

because the field produced by the gate controls the current flowing through the semiconducting channel from source to drain. Current through the gate is not allowed in the industry and is considered detrimental to FET device performance for obvious reasons explained in most college courses on semiconductor electronics, e.g., Sze, Physics of Semiconductor Devices (Wiley, 1981), p.431, because a gate current leaks from the channel.

Also enclosed for the Examiner's consideration is a declaration by inventor, Alexandre M. Bratkovski, containing his expert opinion that the reference to gate current in Sarma is an error.

In conclusion, one of skill in the art at the time the invention was made would not interpret Sarma as teaching or suggesting a gate current creating a magnetic field that rotates electron spins because the Datta-Das spin transistor is known to employ the spin-orbit coupling created by a gate voltage. Claim 1 is thus patentable over Sarma.

Claims 2-11 depend from claim 1 and are patentable over Sarma for at least the same reasons that claim 1 is patentable over Sarma.

Independent claim 12 distinguishes over Sarma at least by reciting, "a magnetic wire; ... and a control region forming a first interface with the magnetic wire ..., wherein ... a current along the magnetic wire creates in the control region a magnetic field that rotates spins of the electrons traversing the control region." In regard to the magnetic wire of claim 12, the Examiner cites the gate of the Datta-Das spin transistor. However, Sarma fails to disclose or suggest that the gate is a magnetic wire or forms an interface with a control region. Further for the reasons set forth above in regard to claim 1, Sarma fails to disclose or suggest "a current along the magnetic wire creates in the control region a magnetic field that rotates spins of the electrons traversing the control region" because Sarma discloses a device using a gate voltage and a spin-orbit interaction to control spin rotation. Accordingly, claim 12 is patentable over Sarma.

Claims 13-21 depend from claim 12 and are patentable over Sarma for at least the same reasons that claim 12 is patentable over Sarma.

For the above reasons, Applicants request reconsideration and withdrawal of the rejection under 35 U.S.C. § 102.

Claims 29 and 30 are added. New claims 29 and 30 depend from respective base claims 1 and 12 and are patentable for at least the same reasons as their base claims. Claim 29 and 30 further distinguishes over Sarma by reciting "first and second" contacts, while Sarma discloses gate have only a single contact.

For the above reasons, Applicants respectfully request allowance of the application including claims 1-21, 29, and 30.

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Respectfully submitted,



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